(No Model.) 2 Sheets—Sheet 1.

J. R. SMITH & W. CHILDS.

SYSTEM OF TELEGRAPHIC AND TELEPHONIC EXCHANGE.

No. 442,734. Patented Dec. 16, 1890.

Fig. 1.

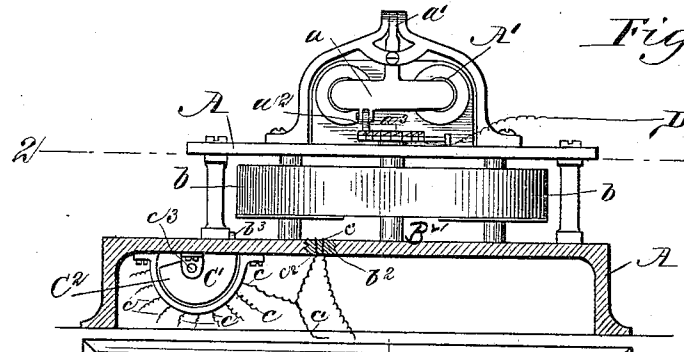


Fig. 3.

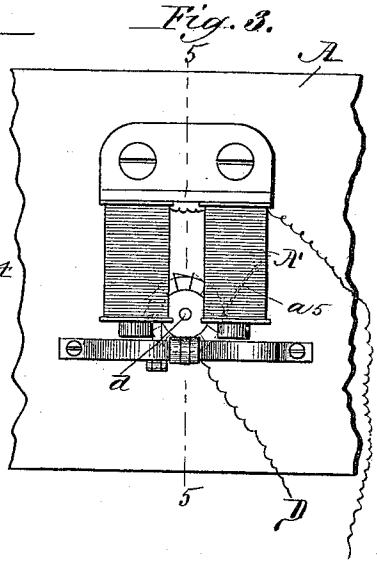


Fig. 2.

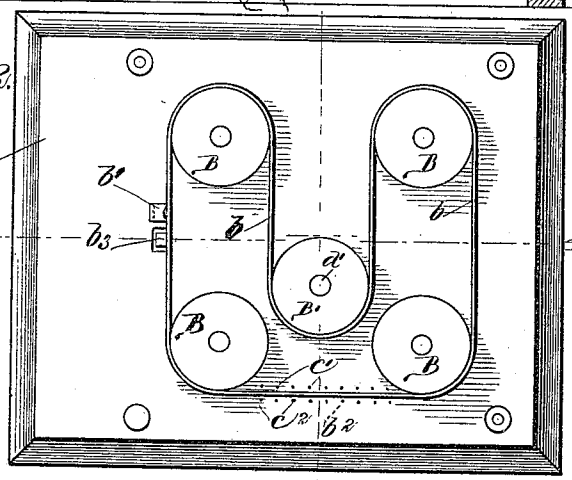


Fig. 4.

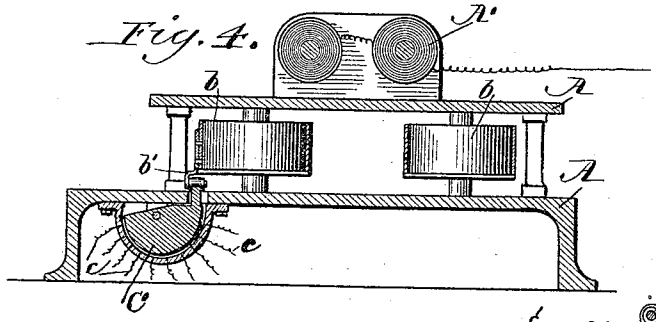
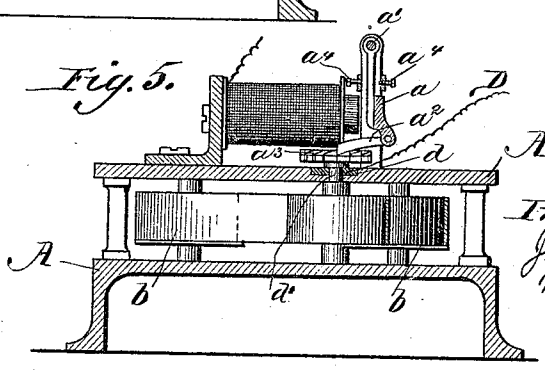


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

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SYSTEM OF TELEGRAPHIC AND TELEPHONIC EXCHANGE.

No. 442,734. Patented Dec. 16, 1890.

Fig. 6.

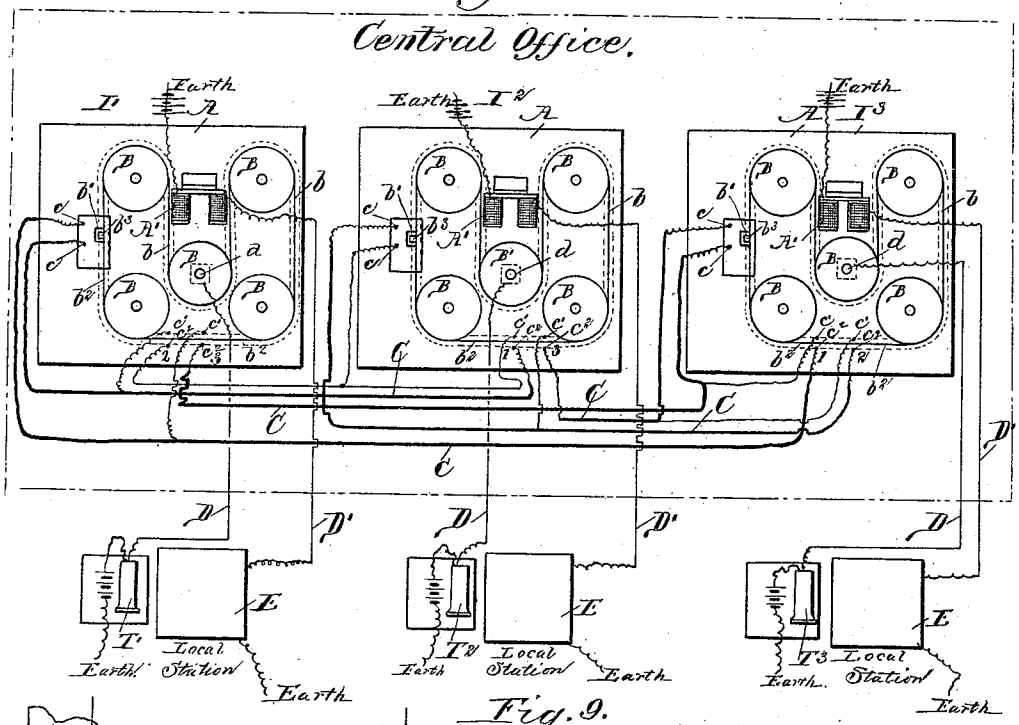
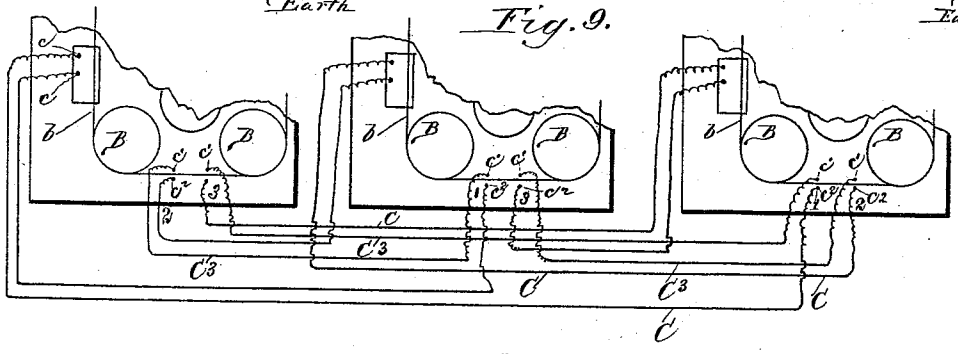


Fig. 9.



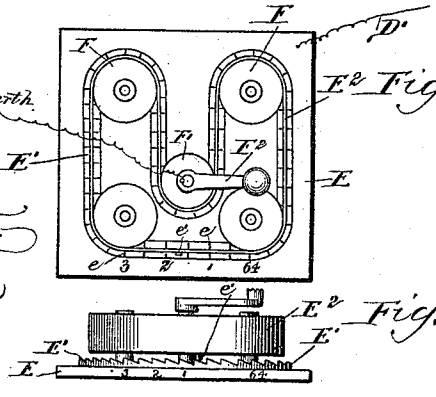


Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE.

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SYSTEM OF TELEGRAPHIC AND TELEPHONIC EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 442,734, dated December 16, 1890.

Application filed September 27, 1889. Serial No. 325,267. (No model.)

To all whom it may concern:

Be it known that we, JOHN R. SMITH and WALLACE CHILDS, citizens of the United States, residing, respectively, at Neosho, in the county of Newton and State of Missouri, and Fort Smith, in the county of Sebastian and State of Arkansas, have invented a new and useful Improvement in Systems of Telegraphic and Telephonic Exchange, of which the following is a specification.

The object of our invention is to furnish a system for telegraphs and telephones whereby connections and disconnections may be made at the central office by the operator at the local stations promptly, secretly, and automatically, thus entirely dispensing with help at the central office. This object we have attained by the mechanisms illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a switching-instrument. Fig. 2 is a horizontal section taken on the line 2 2 of Fig. 1 and shows a plan of such switching-instrument. Fig. 3 is a fragment of a plan or top view of said instrument. Fig. 4 is a vertical longitudinal section of said instrument located on the line 4 4 of Fig. 2. Fig. 5 is a vertical cross-section on the line 5 5 of Fig. 3, looking toward the left. Fig. 6 is a diagram showing the relation of separate switching-instruments in the central office and the wire-connections thereof and the telephone and switch lines. Fig. 7 is a plan view of a circuit maker and breaker in the switch-lines. Fig. 8 is a side elevation of said circuit maker and breaker. Fig. 9 is a plan diagram showing a modification of the arrangement of wires connecting the switching-instruments at the central office.

The switching-instruments are constructed as follows:

Referring to the drawings, A designates the frame of the instrument, which is composed of non-conductive material. On the top of the frame are placed one or more electro-magnets A′, whose armature a is pivoted at a' to a bracket of the frame so as to vibrate freely.

The armature is provided with a pawl a^2, which plays upon a ratchet-wheel a^3 for operating a traveling switch or coupler b', as is presently described. Adjusting-screws a^4 are provided in connection with the armature for regulating and limiting the degree or amount of motion of said armature, so as to control the movement of said ratchet-wheel, which gives movement to the traveling coupler b', and also a spring-pawl a^5 is provided to prevent the backward movement of said ratchet-wheel a^3, as well as to prevent its forward turning more than one notch of the ratchet at each stroke of the armature against said ratchet-wheel. There is journaled in the frame A a series of wheels B, which carry a belt b, made of conductive material, to which the switch or connecting and disconnecting coupler b' is attached, which is moved by the turning of the belt. Said wheels should be provided with flanges B^2.

The conductors of the independent telephone-lines terminate, respectively, in the track or path of the belt, as indicated at b^2, so that by the movement of the belt the coupler b' can be brought into contact with the end of any of said lines thus terminating. Each of the several switching-instruments in the central office is connected to each and all such other instruments of the system by a series of bifurcated wires C, each of said wires having three terminal ends, one of said ends c, Fig. 1, being attached to a concave bed C′, of non-conductive material, and the other two of said ends c' and c^2 being attached in the frame in the path of said several instruments along which the respective traveling couplers b' may be moved. In each concave bed there is a convex piece C^2, which is pivoted at c^3 to the frame of the instrument, and provided with a lug or projection b^3, which is also located in the path of the traveling coupler b'. Said convex pieces C^2 are balanced on their pivots and adjusted so as to be borne down by a slight weight, and when borne down they come in contact with all of the ends c of the wires C, which terminate in the concave beds C′ at separate points insulated from each other, so that said convex pieces, which are of conductive material, will be in electrical connection with all of said ends, and bring them, as it were, all to one point, into the path of the traveling coupler, and when said coupler is placed on the projection b^3 it bears said convex piece down into connection with said

ends c, as stated, and through the same is placed in electrical connection with all of said wires C. When the said coupler b' is removed from the projection b^3, the convex piece will rise and thus break connection with all of said wires C.

The main lines D, which connect the telephones with the various instruments, are connected electrically with the coupler b' by being attached to a metallic collar d or the journal of the metallic shaft d', and thence, through the metallic wheels B', with the belts b, to which said couplers are connected; and when said couplers b' are placed on the projection b^3 of the convex piece the main circuits are connected with all of the instruments of the system through the wires C in such manner that by changing the location of the coupler b' from the projection b^3 to the points c' c^2 any two of said main circuits can be connected with each other for communication through the several transmitters and receivers—as, for instance, T' wants T^2. Then T' moves the coupler b' from its normal position at b^3 of instrument I' to and upon the ends c' c^2 at 2 on said instrument I'. When the said coupler is in this position it is in electrical connection with instrument I^2—that is, the electrical conductor is complete between said instruments I' and I^2—and telephone T^2 can now be "rung up" by telephone T', as in the ordinary way, and conversed with; but if secrecy is desired the coupler of instrument I^2 must be moved to and upon the terminal ends c' c^2 at 1 of said instrument I^2, thereby severing the connection of the line D D of telephones T' and T^2 from the other instrument I^3 by breaking the normal connection through the convex piece C^2 of said instrument I^2 in the manner before described. In like manner each switching instrument of the system may be connected to any other of said instruments and communication may be established between any pair of telephones belonging to the system and no pair interfere or prevent any other pair from being used similarly and at the same time.

For the purpose of moving the respective couplers b' the electro-magnets A' are respectively brought into operation by means of switch-lines D' in such manner as to bring the pawl a^2, pivoted to armature a, to play upon the ratchet-wheel a^3 in such manner as to propel the belt b and carry the coupler b' along the path b^2 to the point desired. The impulses necessary to effect this are produced by a current maker and breaker composed of metallic plate E, connected in the circuit with the line D', and having a series of metal points e projecting therefrom through a plate E', of non-conductive material, in such manner that the circuit will be made and broken successively as the opposite electrode e' of said circuit is passed over the plate E' in rubbing contact with the points e. Said opposite electrode e' is attached to a traveling belt E^2, which forms part of the circuit with the line D' and is supported on wheels F, which are arranged similarly to the wheels B' of the switching-instruments in the central office, so that by rotating the same, said belt is made to move and carry the electrode e' along onto the points e for making and breaking the said circuits. We prefer to make the plate E' along the path of said electrode e' in the form of a ratchet, the teeth of which form graduations which mark the distance of travel of said electrode e', which is preferably made to engage in the notches as a pawl to prevent backward movement.

The points e are numbered from one up to correspond to the number of instruments at the central office, and said numbers are spaced to correspond with the terminals c' c^2 along the paths b^2 of said instruments, so that the movement of the electrode e' determines the movement of the coupler b' along the path b^2. The operator at the current maker and breaker is thereby enabled by turning the crank F^2 and noting the movement of the electrode e' to move and to locate or place the coupler b' on any of the terminals c' c^2 in the path b^2 with which it is desired to form a connection.

The circuits for transmitters and receivers and for the current maker and breaker are made with batteries and conductors in electrical connection in the usual manner, and it is not deemed necessary to describe them in detail in order to a full understanding of our invention.

The parts denominated the "concave bed" and the "convex piece" need not necessarily be made in the form shown, that form being merely suggested as a form which will give more contact-surface within smaller space than a plain or flat surface.

It should be observed that each switching-instrument in the system should have as many of the wires C as there are other of said switching-instruments in the system, each of said wires starting from its respective terminal c^2 in the path b^2 of each particular instrument and running to every other instrument of the system and terminating in the paths b^2 at c', and also in the concave beds C' thereof at c, in order to have both the "call" with all the receivers and the secret communication in pairs between said transmitters and receivers.

The branches of the wires C, which terminate at c' in the several switching-instruments, serve to form the secret connection between the pairs of the separate circuits, and we prefer to use the wires C provided with branches at one end terminating in separate points, as shown; but it is obvious that if the branches which terminate at c' were severed from any two of the wires C and had their ends thus severed joined together said severed branches would then form a separate wire between the pair of switching-instruments in which they terminate, and that said pair of switching-instruments would then be

connected by a separate line C^3, as shown in Fig. 9, which would serve to form the secret connection in lieu of the branches c' c' when connected to the wires C and in substantially the same manner.

Having thus described our invention, what we claim is—

1. In a system of telegraph or telephone exchange having independent transmitters and receivers connected in open circuits converging in a central station and terminating in switch-paths, the combination of a belt, as *b*, in electrical connection with each of said circuits and provided with an electrode, as *b'*, and wheels for supporting and operating said belts over the switch-paths, and an electro-magnetic propelling device therefor in a line from one of the stations, whereby said electrode may be guided and moved into connection with each of the circuits terminating in the said switch-paths, as specified.

2. In a system of telegraph or telephone exchange having independent transmitters and receivers connected in open circuits converging in a central station, the combination of a switching-instrument in connection with each of said circuits, and wires C, for connecting said switching-instruments in the central station, said wires having one end run to or grouped in a single terminating point on each separate switching-instrument and having their opposite ends terminating in pairs in the switch-paths of the several switching-instruments, whereby each transmitter and receiver of the system may be connected individually or collectively with all of the other transmitters and receivers of the system.

3. A system of telegraph or telephone exchange having independent transmitters and receivers connected in open circuits converging in a station, a switching-instrument constructed substantially as described, and a switch-board in which the circuit-wires terminate at points c' c^2 in a path on the switch-board, a series of wheels carrying a belt over said path, and electro mechanism for operating said wheels and belt.

4. A system of telegraph or telephone exchange having a switch-board in which circuit-wires terminate, an electrode-coupler attached to a movable belt supported and operated by one or more wheels, said belt and one of said wheels being in electrical connection in the circuit, and an electro-magnetic propelling device in a line from one of the stations in connection with said wheels to move said electrode-coupler into electrical connection with any and all of the circuits so terminating.

5. A system of telegraph or telephone exchange having independent transmitters and receivers connected in open circuits converging in a central station and terminating in switch-paths, substantially as shown—that is, having the terminal ends of one portion of all the circuits but one grouped together at one point, as *c*, in the switch-path and each circuit so grouped connected by a branch to another point, as c^2, in all the other paths but one, so that the other portion of each of the circuits may be placed in electrical connection with all the circuits by means of a movable electrode and breakable connection constructed substantially as specified.

6. A system of telegraph or telephone exchange having independent circuits converging in a central station and terminating in switch-paths, in which one end of all the circuit-wires but one are grouped at one point in each path, and each circuit so grouped connected by two branch wires, one of which terminates at another point in the same path containing the group and the other of which terminates in a separate switch-path of the system, and a movable electrode adapted to be moved in one of said paths between the points where all the circuit-wires but one are grouped and any of the points in said path where said branch wires terminate, and electro mechanism, substantially as shown and described, for operating said movable electrode from the local stations, as set forth.

7. In a system of telegraph or telephone exchange of the character shown and described, a circuit maker and breaker consisting of an electrode *e'*, in combination with a movable belt supported and operated by two or more wheels, said belt being in electrical connection with the circuit, and means, substantially as shown, for propelling said belt to move said electrode in rubbing contact with a series of insulated points in said circuit, as and for the purpose specified.

8. A system of telegraph or telephone exchange having a switching-instrument at the central office in connection with each of the main circuits, an independent circuit in connection with each of said switching-instruments, and a circuit maker and breaker consisting of an electrode *e'* and a movable belt supported on wheels, said belt being in electrical connection with said independent circuit and means for propelling said belt, for the purpose specified.

9. A switch-board in a central office having electrical connection with a local station and electro-magnetic propelling devices in connection therewith to move an electrode-coupler along a path, as *b*, on said switch-board, in combination with a wire, as C, having a branch, one end of said wire and the end of said branch terminating at the points *c* *c'*, respectively, on said switch-board and another of its ends at C^2 in the path *b* of another similar switch-board with wire connections, and electro-magnetic devices in a line from a local station to move a like electrode-coupler along its path *b*, substantially as and for the purpose specified.

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